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DEVICE FOR THE CONTINUOUS FILLING AND CLOSING OF CARDBOARD/PLASTIC COMPOSITE PACKAGES WHICH ARE OPEN ON ONE SIDE; AND A CELL CAGE FOR TRANSPORTING SUCH PACKAGES IN THE DEVICE

The invention relates to a device for the continuous filling and closing of cardboard/plastic composite packages which are open on one side, in particular beverage packages, with at least one filling zone for filling the open packages, and a closing zone for closing the open package end, wherein the individual zones are rotating functional wheels with recesses arranged on the outside, as well as a filling wheel and a closing wheel, wherein the individual packages are arranged in cell cages which are successively transferred to the individual wheels, wherein the cell cages are held in the recesses of the wheels in a non-positive manner by means of magnets for transferring the cell cages, transfer wheels with recesses arranged on the outside are provided and in that the transfer wheels comprise means for rotating the cell cages in their recesses. The invention also relates to a cell cage for transporting such packages in the device.

A host of different designs of devices for the filling and closing of cardboard/plastic composite packages, in particular beverage packages, are known. First of all, a distinction is made between intermittent devices and continuously operating devices. In the case of intermittent devices, the package is produced step-by-step on an mandrel wheel on whose individual stations a

package which is open on one side is made from a package sleeve. In this arrangement, the cycle speed of the mandrel wheel dictates the speed of the following steps during filling and closing the packages, and limits this speed. The speed cannot be increased at will because sloshing over of the product, as a result of the cyclic transport after filling the still open packages, cannot be prevented. Furthermore, mechanical wear increases.

Moreover, intermittently operating filling devices are disadvantageous because as a rule they are designed as longitudinally operating machines, i.e. the individual process steps take place in sequence along a straight machine line. While it is possible to design these machines so that they have several lines, this would increase the complexity of the construction and result in poor access to the tools arranged on the inner lines. Furthermore, longitudinally operating machines are associated with the disadvantage in that fixed coupling of the packages guided along transport chains always causes a standstill of the entire system, even if only one fault has occurred in a single location. Here again, the fastest speed is always only as fast as the maximum speed of the slowest-operating unit within the line.

For this reason, continuously operating filling devices have been developed which are also designed as longitudinally operating machines. In these machines, the packages are moved along evenly, so that the previously mentioned sloshing over can be excluded, but it means that many tools and functional components needed have to be arranged so as to run in unison. This increases the associated design expenditure and thus in turn wear and tear.

Further continuously operating devices are known for filling glass bottles. To this effect, the bottles are transported in sequence in single file, wherein the mechanical strength of the bottles can be used for transmitting the required pressure forces. However, due to the lack of stability of the open cardboard/plastic composite packages, this method cannot be used for filling devices used for such packages.

~~It has therefore~~A device having all the features of the preamble of claim 1 is known from WO-A1-95/02539. The usage of cell cages for accomodating non-rigid packages alone is already known from EP-A1-0 727 367. Also it has already been proposed (EP-B1-0 707 550) to provide a continuously operating filling device in which the cardboard/plastic composite packages are arranged in cell cages which in sequence are conveyed to various functional wheels for the filling, closing etc. of the individual packages, wherein the functional wheels are star wheels which comprise recesses distributed around their circumference, and wherein the cell cages are held in a non-positive way in the recesses of the functional wheels by means of magnets. While a holding arrangement using magnets provides design advantages, the magnets nevertheless have to be designed such that their tractive force is sufficiently strong to reliably hold the cell cages in their position. This is however associated with the disadvantage in that a relatively strong force is required for detaching the cell cages from the permanent magnets, and in that detaching a cell cage during the outward transfer process takes place suddenly and with a jerk. However, this is not desirable for the filling process, since, in particular after filling the packages

and before closing them, sloshing over of the package contents cannot reliably be excluded.

Based on this, it is the object of the present invention to design and improve the above-mentioned and described device for the filling and closing of cardboard/plastic composite packages which are open on one side, in such a way that the above-mentioned disadvantages are avoided. Furthermore, it is desirable that the highest possible flexibility with regard to producing different package formats is achieved while design and maintenance expenditure is kept to a minimum.

This object is met in that ~~transfer wheels with recesses arranged on the outside are provided for transferring the cell cages between the individual wheels, and in that the transfer wheels comprise~~as a means for rotating the cell cages in their recesses~~.~~, for each recess a rotatably held control element is provided which by way of a drive is rotated such that the cell cage adjoins the magnets of the functional wheels (inward transfer) or is detached from them (outward transfer) without any jerking or jolting.

The invention reflects the finding that despite maintaining a non-positive holding arrangement using magnets it is possible to achieve a particularly gentle outward transfer of the packages from a functional wheel to a transfer wheel in that the entire cell cage is rotated on its vertical axis. If only one magnet, or several magnets located on top of each other, is/are provided, rotation causes detachment no longer to take place vertically in relation to the magnet surface, but almost parallel to it. Even more pronounced is the

advantage, as will be explained in detail below, if several magnets are used, arranged around the circumference. For, such an arrangement causes the lifting or putting in place of the magnets in succession, so that only a lighter force is required and moreover noise generation is also reduced.

According to a preferred teaching of the invention, filling of the packages to be filled takes place in an aseptic way. To this effect, for the purpose of sterilising the packages, a sterilising wheel is provided upstream of the filling wheel, and the entire transport zone from the sterilising wheel to the filling wheel to and including the closing wheel is a closed sterile channel, so that any entry of dirt or germs into this sterile zone is reliably prevented.

With the device according to the invention it is possible to fill both two-part packages which comprise a container and a cover, and single-part folding packages as they are available on the market in a multitude of designs as flat-ridge multi-layer drink cartons. In the latter case it is necessary, upstream of the filling wheel, or, in the case of a sterilising wheel already upstream of this sterilising wheel, to provide a prefolding wheel which is used for the prefolding of the still open end of the package, so as to facilitate the subsequent closing process. In such a design, in a further embodiment of the invention, a package forming wheel is provided as the last wheel, which is used to impart its cuboid final shape to the package that has just been closed, and if necessary to fold back the still protruding ears of the package.

In the device according to the invention, with almost free choice the diameter of the individual functional wheels provides the opportunity to optimally match the fastest transport speed and the respectively required treatment duration in the respective position. In this arrangement, the moved tools are firmly installed on the rotating functional wheels so that relative movement or a return of the tools is not necessary. In this arrangement, the transfer wheels can be extremely small when compared to the functional wheels. ~~In order to achieve this, a further teaching of the invention provides for the cell cage, for inward transfer, to rest without jerking against the magnets of the functional wheels, and, for outward transfer, to detach from them.~~ By way of means to rotate the cell cages, in their recesses a rotably held control element is provided for each recess, wherein said rotatably held control element is rotated via a drive in such a way that the cell cage rests against the magnets of the functional wheels without jerking, and detaches from them in the same manner. To this effect the control element is of a shape which engages the cell cage in a positive-locking manner so that the device according to the invention in a way establishes a combined non-positive locking connection / positive-~~positive~~ locking connection. Preferably, the end of the control element which protrudes into each control of the transfer wheel is designed in a fork-like manner.

Preferably, the control system is a cam control with a fixed control slide for guiding a sliding block arranged on the control element. Since the transfer wheels do not comprise magnets, holding of the cell cages has to take place in some other way. A preferred embodiment of the

invention provides for guide rails for constrained guidance of the cell cages to be arranged in the region of the transfer wheels, at a distance from these transfer wheels.

According to a further teaching of the invention, all wheels including the transfer wheels are arranged in one plane so that the cell cages also only rotate in one plane. Consequently, the empty packages are fed from above into the cell cages, and the full packages are removed upward from the cell cages. According to a further preferred embodiment of the invention, inserting and removing the packages into/from the cell cages takes place along a helical path so that this has no influence on the transport speed of the cell cages. To this effect, an automated feed device may be used.

A further embodiment of the invention provides for the number of cell cages used to be finite, and to correspond to the number of the maximum occupiable accommodation stations of all wheels and transfer wheels. In other words, the rotating cell cages quasi correspond to a "transport chain" except that they provide a substantial advantage in that the individual "chain members" are not linked to each other, but instead can easily be exchanged if required.

A cell cage provided for use with the device according to the invention features an open-top cell body for accommodating a package to be filled, and at least one collar, connected to the cell body, which collar comprises at least one upward or downward protruding driver element, wherein the driver element engages the fork of the control element, so as to allow rotation of

the cell cage within the recess of the transfer wheel on the vertical axis of said cell cage. For improved guidance and an associated increase in the transport speed it is however advantageous if the cell cage comprises an upper and a lower collar. In order to achieve rotation according to the invention, the collars are rounded on the outside.

A further embodiment of the invention provides for each collar to comprise at least one bearing pin. This bearing pin is situated on the outside of the recesses of the functional wheels or transfer wheels and according to a further preferred teaching of the invention is made from a ferromagnetic material so that magnets which are correspondingly arranged on the wheels ensure a safe grip between the pickup station in the recess of a wheel and the cell cage.

In a further preferred embodiment of the invention, each cell body comprises four wall plates and a cell floor. In this arrangement, the cell floor is preferably designed so as to be height-adjustable within the cell body so that with the package cross-section remaining the same, different package formats can be accommodated. It is clear that the device according to the invention makes it possible to fill a host of packages of different sizes. To this effect, in each case all the cell cages are uniformly matched to a package cross section. It is particularly advantageous that for each package cross section only one set of cell cages has to be kept in stock, without any intervention in the machine becoming necessary. As has already been mentioned, changeover to various package sizes within a package cross section takes place only by moving the cell floors within the

cell bodies, without the need for exchanging the entire set of cell cages.

According to a further embodiment of the invention, the cell cage comprises at least one index pin for determining its orientation. Such a design is particularly expedient in those cases where during filling of the package the orientation of the package in the cell cage is important, for example in the case of weakened zones arranged on one side, or pouring elements attached to one side. By means of the index pin it is thus easily possible, in spite of the round collar, to automatically carry out unambiguous position determination of the package in relation to the functional wheels.

Below, the invention is explained in more detail with reference to a drawing which shows but one preferred embodiment. The drawing shows the following:

Fig. 1 a diagrammatic top view of the device according to the invention;

Fig. 2 a perspective view of the section of a transport wheel and a cell cage, to clarify the accommodation of a cell cage;

Fig. 3 a detailed perspective view of the cell cage from Fig. 3;

Fig. 4 a perspective view of a transfer wheel with a diagrammatically shown cell cage;

Fig. 5 a top view of a transfer wheel at the time of outward transfer of a cell cage from a functional wheel;

Fig. 6 a top view of a transfer wheel at the time of inward transfer of a cell cage to a functional wheel; and

Fig. 7 an alternative solution for outward transfer of the packages from the cell cages.

Fig. 1 diagrammatically shows a top view of a device according to the invention. Shown are the differently-sized wheels which will be explained in more detail below. Depending on whether or not the individual packages to be filled during conventional filling are to be filled with open top, in special cases with the bottom open towards the top, i.e. the package placed upside down, it is necessary, before the filling process, to prefold the top or bottom region which is to be closed off later. In the embodiment shown, this takes place on a prefolding wheel 1. Of course, the prefolding tools have to be replaced by welding tools if the packages P to be filled are packages whose aperture is not closed off by folding and sealing, but instead by putting a plastic cap or the like in place. In this case it is also possible to carry out sterilising and filling through the pouring aperture arranged in the cap.

The prefolding wheel 1 is followed by a sterilising wheel 2 which has the largest diameter because the process of sterilising the packages P to be filled takes longer than all the other processes. The tools necessary for this are arranged within or above the sterilising wheel 2 and are

not shown in the drawing. The sterilising wheel 2 is followed by a filling wheel 3 in which the packages are filled. The filled package is then closed in a closing wheel 4 and is finally given the final shape in a package forming wheel 5. For example, in this process, package "ears" that still protrude are put in their proper place so that the package assumes its right parallelepiped shape.

The embodiment shown comprises transfer wheels 6, 6' between the individual above-mentioned wheels, wherein said transfer wheels 6, 6' are arranged in the same plane as the remaining wheels 1 to 5, thus ensuring continuous transport of the packages P to be filled. In Fig. 1, the transfer wheel 6' is larger than the other transfer wheels 6.

The diagram shows that most of the circumference of the sterilisation wheel 2, the entire filling wheel 3 and most of the closing wheel 4 are designed in an encapsulated way as a sterile channel 7. This reliably prevents dirt or germs entering the interior of the packages P after the sterilisation process.

According to the invention, transport of the packages P to be filled takes place by means of cell cages 8 which will be described in detail below. By means of an automatic feeder device 9 (not shown in detail), the packages P to be filled are transferred from above into the open-top cell cages 8, namely along a helical path (not shown) in the area of the prefolding wheel 1. In the embodiment shown, which is a preferred embodiment, outward transfer of the filled and closed packages P' takes place in the region of the package forming wheel 5,

wherein here too, the packages P' are moved along a helical path (also not shown) from the plane of the cell cage and are thus conveyed to a point where a pouring element is applied or where palletising and dispatch take place.

As shown in Fig. 2, in the embodiment shown, which is a preferred embodiment, the transport wheels comprise two discs or rings 10 and 11 which are spaced apart parallel to each other, wherein said discs or rings 10 and 11 comprise accommodation spaces for the cell cages 8, with said accommodation spaces being distributed around the circumference of said rings 10 and 11, with said accommodation spaces being in the shape of recesses 12. Fig. 2 also shows that the recesses 12 in the upper ring 10 comprise an upper bearing surface 13, and in the lower ring 11 a corresponding lower bearing surface 14.

Fig. 2 also shows the diagrammatic design of a cell cage 8. Said cell cage comprises a cell body 15 for accommodating the open-top package. The cell body 15 comprises an upper collar 16 and a lower collar 17 which are of equal size and which are circular in shape. Preferably, each of the two collars 16, 17 comprise two bearing pins 18 which protrude vertically upward or downward from said collar 16, 17, with said bearing pins 18 being suitable and destined to "dock" the circular cell cages 8 always tangentially to the corresponding wheels. It is shown how a cell cage 8 can be accommodated by the recesses 12 in the rings 10 and 11. For the sake of improved clarity, the cell cage 8 is however not shown in its operating position but instead at some distance from it. Magnets 19 which are arranged in the end region of the bearing surfaces 13 or 14 are positioned such that

they correspond to the bearing pins 18 which to this effect expediently comprise a ferromagnetic material. It has been shown that this simple form of non-positive connection of the respective wheel and cell cage 8 is sufficient to safely hold the cell cages 8 in the recesses 12 of the wheels. In this arrangement, the support surfaces 13A and 14A secure the height position of the cell cages 8 by means of the collars 16 and 17.

Fig. 3 shows a possible embodiment of the cell cage 8 in greater detail. It is shown that the cell body 15 comprises four wall plates 15A, 15B, 15C, 15D which in their upper region are angled outward slightly in order to facilitate automatic placement of the packages P to be accommodated. In order to be able to fill packages P of different sizes with one and the same cell cage 8, the lower part of the cell body 15 is designed as a height-adjustably arranged cell floor 20, which can be fixed along the double arrow (not shown) at any height required by the various package formats. In the embodiment shown, the upper collar 16 comprises a driver pin 21, whose function is described below, which in the embodiment shown protrudes downward. The driver pin 21 can at the same time be an index pin which makes it possible to maintain the initially taken up position of the package P in the cell cage 8 throughout the entire passage through the filling machine. This is necessary because otherwise the circular cell cage 8 with its bearing pins 18 might rotate on a vertical axis to two different positions by 180° along the device. The use of this index pin is always necessary where the type of package to be filled requires unequivocal positioning, as is for example the case in packages which comprise a pouring element arranged on one side; or a weakened zone arranged on one

side, with a pouring element having to be affixed to said weakened zone.

Finally, Fig. 4 shows the transfer of the cell cage 8 from one transport wheel to another. The already mentioned transfer wheel 6 also comprises an upper and a lower wheel element, both of which are interconnected in a rotationally rigid way by means of a shaft 22. This transfer wheel 6 is not driven; the shaft 22 is accommodated by a bearing 23 which is rigidly connected to the device. The transfer wheel 6 also comprises an upper bearing surface 13' and a lower bearing surface 14'; however, these bearing surfaces do not comprise magnets in their end regions. A guide rail 24 holds the cell cage 8 in the respective recess of the transfer wheel 6, which in the embodiment shown comprises six recesses. After changing over into the circular path of the next transport wheel, which in the embodiment shown is for example the sterilisation wheel 2, the cell cages 8 leave the transfer wheel 6 and are moved into the corresponding recesses 12 of the sterilisation wheel 2 until the non-positive connection between the bearing pins 18 and the magnets 19 becomes effective.

In order to clearly show the function, in Fig. 4 the rotation means of the cell cages are not shown. The function of the design according to the invention is shown with reference to Figs 5 and 6, wherein for a better overview outward transfer and inward transfer are shown in separate drawings.

Fig. 5 shows a snapshot taken during outward transfer of a cell cage 8 from a functional wheel, in the present instance the prefolding wheel 1, by means of the transfer

wheel 6. It can be seen that the right bearing pin 18 in Fig. 5 has already detached itself from the magnet 19. In this position, the bearing pin 18 has however already moved away from the circular path U_6 around the centre of the transfer wheel, namely by means of rotation of the cell cage 8 in the interior of the recess 12', due to the interaction between the driver fork 26 of the control element 25 around the driver pin 21. In the embodiment shown, which is a preferred embodiment, rotation of the control element 25 takes place by means of a cam control, wherein below the upper rim of the transfer wheel 6, a control slide 27 is arranged so as to be fixed, by means of which a sliding block 28 connected to the control element 25 is moved. In this arrangement, the geometry of the control slide 27 is optimised for the two "problem zones" of outward transfer and inward transfer. It is clear that the control slide 27 goes all the way round, even if for reasons of improved clarity only part of it is shown. U_1 denotes the circular path of the holding pins 18 around the prefolding wheel 1. It is clear that as a result of the rotation, according to the invention, of the cell cage 8, transfer from the circular path U_1 to the circular path U_6 does not take place by jerks and jolts, but instead, along a controlled circular path U_S. For reasons of clarity, the guide rail 24 for outer constrained guidance of the cell cages 8 in the region of the transfer wheel 6 is not shown either.

Fig. 6 shows the situation during inward transfer of a cell cage 8 onto a functional wheel; in the case shown, the sterilisation wheel 2. As a result of the action of the control slide 27, the control element 25 rotates the cell cage 8 rearward before it reaches the sterilisation wheel 2 so that the advancing holding pin 18 does not

continue on the circular path U_6, but instead moves on a controlled curve U_S and in this way tangentially approaches the circular path U_2 of the sterilisation wheel 2 in a defined way. It is quite evident that as a result of the control according to the invention, "gentle" inward and outward transfer of the cell cages 8 in the region of the transfer wheels 6 takes place. This is particularly important in the region of transfer between the filling wheel 3 and the closing wheel 4, where the contents of the filled packages P readily tend to slosh over. As a result of the two magnets 19, which are arranged on the sides of the recesses 12, not at the same time losing or establishing contact with the holding pin 18, the tractive forces are significantly reduced. The design according to the invention provides a further advantage in that noise emission is also significantly reduced.

It is understood that the embodiment shown depicts but one example, and that apart from the functional wheels mentioned, there can be still further wheels, for example with tools for affixing a pouring element. Likewise, the cell cages 8 for accommodating packages P with a rectangular cross-section are only shown as an example. It is of course also possible to match the cell cages to any desired special forms.

Finally, Fig. 7 diagrammatically shows an alternative embodiment of the device according to the invention as far as the design solution of outward transfer of the packages P from the cell cages 8 is concerned. Since the packages P to be transported are relatively fragile, this solution provides for the filled packages P to be clamped from top and bottom by corresponding holding elements 29,

30, thus maintaining their horizontal transport path, while the cell cages 8 are moved vertically downward on a corresponding outward transfer wheel (not shown) until the packages P are released and can be conveyed to the downstream unit, for example a palletising station.